

**Response Under 37 CFR 1.116**  
**Expedited Procedure**  
**Examining Group 3673**  
Application No. 10/541,471  
Paper Dated: June 17, 2008  
In Reply to USPTO Correspondence of April 17, 2008  
Attorney Docket No. 4663-051882

**REMARKS**

Claims 28, 32 and 41 are currently amended. Support for the amendments may be found in the specification, specifically at page 7 and the claims as originally filed. No new matter has been added. Accordingly, claims 28-44 are currently pending in the present application.

**Rejections Under 35 U.S.C. §102(e) and §103(a)**

**Zachariah et al.**

**Novelty over Zachariah et al.**

Claims 28-40 are rejected under 35 U.S.C. §102(e) as being anticipated by Zachariah *et al.* (U.S. Patent Application No. 2007/0207084, herein after “Zachariah”). The Office Action asserts that Zachariah teaches a process of making alumina particles wherein at least one nonreactive salt (the matrix salt) is used in a spray-pyrolysis system to form nanoporous particles. See Office Action at pages 5-6.

The Examiner has the initial burden of establishing anticipation (MPEP §2106). To anticipate a claim, a single source must contain all of the elements of the claim (MPEP §2121). Zachariah teaches neither the formation of plate-like alumina nor the ratio of width to diameter and volume fraction of the diluents particles as required by claim 28, and thus does not anticipate claim 28 or dependant claims 29-40.

In a telephone conference call with Applicants’ representative, Julie Meder, the Examiner clarified his comments regarding Zachariah on page 5 of the Office Action. The Examiner stated that the sentence should read, “With respect to Zachariah, claim 28 is not limited to plate-like alumina, because the limitation is not recited in the body of the claim

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(emphasis added for clarification).” However, step b) of claim 28 clearly includes the limitation of “heat treating the mixture to form substantially discrete plate-like alpha alumina particles dispersed in the diluents (emphasis added)”. Thus, Zachariah does not teach every limitation of rejected claim 28.

However, solely in an attempt to expedite prosecution, claim 28 has been amended to include the limitation that the plate-like particles have an aspect ratio of width to diameter of between 1:10 and 1:100. Basis for this amendment comes from page 7 of the PCT specification as originally filed. The feature of original claim 32 has been incorporated into claim 28. Claim 32 has been replaced with the limitation that the aspect ratio is between 1:20 and 1:50.

As a consequence of these amendments, newly amended claim 28 reads as follows:

A process for the production of plate-like alumina particles comprising the steps of:

forming a mixture of nano-sized particles of an aluminium precursor compound and a sufficient volume fraction of a diluent, wherein the sufficient volume fraction of the diluent is at least 80% of the total volume of the mixture; and,

heat treating the mixture to form substantially discrete plate-like alpha alumina particles dispersed in the diluent, the plate-like particles having an aspect ratio of width to diameter in the range of 1:10 and 1:100, wherein the step of heat treating the mixture is conducted below the melting point of the diluent.

As previously stated, paragraphs [0092] to [0095] of Zachariah provide a lengthy and detailed analysis of the morphology of the nanoporous aluminum oxide particles produced by the Zachariah patent. The particles produced using the Zachariah process are porous “spherical, loosely aggregated particles” or “highly spherical, nonporous particles following salt removal”. Spherical particles (or spheroidal or equiaxed particles) essentially

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have similar size in all three dimensions. Plate-like particles form with restricted growth in one dimension and unrestricted growth in the other two dimensions, resulting in a thin flat disc-like particle. In terms of properties, both behave very differently. It is highly unlikely that particles produced by the spray-pyrolysis process of Zachariah could ever be plate-like, as it is impossible to produce plate-like sprayed liquid droplets.

Claim 28 has also been amended to include the limitation of original claim 32, that the “sufficient volume fraction of the diluent is at least 80% of the total volume of the mixture”. Zachariah states that the mole ratio of aluminium salt precursor to matrix salt must be in the range of 1:1 to 1:5 and ideally between 1:1 and 1:3. In the examples given whereby the precursor salt is aluminium nitrate and the matrix salt is sodium chloride, the resulting volume fraction of matrix salt in the dried droplets would be 11% (mol ratio 1:1) to 38% (mol ratio 1:5). This is well below the range specified in newly amended claim 28.

Zachariah clearly does not teach each and every limitation of Applicants’ currently claimed invention. Withdrawal of the rejection is respectfully requested.

Obviousness over Zachariah *et al.*

Claims 28-40 are rejected under 35 U.S.C. §103(a) as being obvious over Zachariah *et al.* The Examiner does not articulate a reason as to why Zachariah renders the present invention obvious.

The recently revised Examiner guidelines for assessing obviousness set forth detailed requirements based on asserted rationales for obviousness. The Rationales To Support Rejections Under 35 U.S.C. §103 provide the following possible rationales:

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- (A) Combining prior art elements according to known methods to yield predictable results;
- (B) Simple substitution of one known element for another to obtain predictable results;
- (C) Use of known technique to improve similar devices (methods or products) in the same way;
- (D) Applying a known technique to a known device (method or product) ready for improvement to yield predictable results;
- (E) “Obvious to try” – choosing from a finite number of identified, predictable solutions, with a reasonable expectation of success;
- (F) Known work in one field of endeavor may prompt variations of it for use in either the same field or a different one based on design incentives or other market forces if the variations are predictable to one of ordinary skill in the art; and
- (G) Some teaching, suggestion, or motivation in the prior art that would have led one of ordinary skill to modify the prior art reference or to combine prior art reference teachings to arrive at the claimed invention.

See MPEP 8<sup>th</sup> Edition, rev. 6, §2141.

As stated above, the Examiner gives no rationale for making this obviousness rejection. As such, Applicants proceed with the understanding that this rejection conforms to rationale G quoted above. The MPEP further sets forth the requirements for an obviousness rejection under this rationale:

To reject a claim based on [rationale G], Office personnel must resolve the Graham factual inquiries. Then, Office personnel must articulate the following:

- (1) a finding that there was some teaching, suggestion, or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings;

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(2) a finding that there was reasonable expectation of success; and

(3) whatever additional findings based on the Graham factual inquiries may be necessary, in view of the facts of the case under consideration, to explain a conclusion of obviousness.

The rationale to support a conclusion that the claim would have been obvious is that “a person of ordinary skill in the art would have been motivated to combine the prior art to achieve the claimed invention and that there would have been a reasonable expectation of success.” DyStar Textilfarben GmbH & Co. Deutschland KG v. C.H. Patrick Co., 464 F.3d 1356, 1360, 80 USPQ2d 1641, 1645 (Fed. Cir. 2006). **If any of these findings cannot be made, then this rationale cannot be used to support a conclusion that the claim would have been obvious to one of ordinary skill in the art.**

See MPEP 8<sup>th</sup> Edition, rev 6, §2143

For at least the following reasons, the Examiner has not shown that claims 28-40 are obvious over Zachariah.

The prior art does not teach, suggest or motivate one of skill in the art to modify the teachings of Zachariah. The Office Action does not provide such reason, suggestion, or motivation indicating how or why a person skilled in the art, and armed with the teaching of Zachariah, would have been motivated to alter the heat treatment or adjust the volume fraction of the diluents to form plate-like aluminum nano-particles. This is because Zachariah is entirely focused on the production of porous spherical aluminum particles. In addition, the range of aluminum salt precursor to matrix salt as taught by Zachariah is lower than the range recited in newly amended claim 28. A reasonable expectation of success in the production of plate-like alumina particles by the proposed combination or modification would not be possible (MPEP §2143.02). Hence, claims 28-40 are non-obvious over Zachariah.

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A *prima facie* case of obviousness may be rebutted by showing that the art, in any material respect, teaches away from the claimed invention (MPEP §2144.05). A reference may be said to teach away when a person of ordinary skill, upon reading the reference, would be discouraged from following the path set out in the reference, or would be led in a direction divergent from the path that was taken by the applicant.

A person skilled in the art and faced with the problem of producing plate-like alumina particles within the range of aluminum salt precursor to matrix salt would consider Zachariah irrelevant since it does not teach the production of plate-like alumina particles and it teaches away from the claimed invention, as discussed in the paragraphs above.

A rejection under 35 U.S.C. §103 requires a clear articulation of the reason(s) why the claimed invention would have been obvious (MPEP §2142). Therefore, the prior art, as a whole, must contain some implicit or explicit reason, suggestion, or motivation for a person of ordinary skill to modify the reference as proposed in the Office Action (MPEP §2143.01). Zachariah clearly does not satisfy these requirements. Applicants respectfully request withdrawal of the rejection.

Zachariah et al. over Mohri et al.

Claims 41-44 are rejected under 35 U.S.C. §103(a) as being obvious over Zachariah in view of Mohri *et al.* (U.S. Patent No. 6,521,203, hereinafter “Mohri”). The Examiner states that while Zachariah does not expressly teach that the aluminum precursor is milled, Mohri teaches the step of ball milling agglomerated coarse particles. The Examiner concludes that it would have been obvious to alter the process of Zachariah to include the step of ball milling. See Office Action at page 4. Applicants respectfully disagree with the

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rejection.

Claims 41-44 define over the teachings of Zachariah in view of Mohri. In the Office Action, the Examiner acknowledges that Zachariah does not expressly teach that the aluminum precursor is milled, but notes that Mohri teaches a process of treating alumina or aluminum hydroxide, including milling agglomerated coarse particles. See Office Action at page 4, referring to column 2, lines 21-35 of Mohri. As stated previously, at column 2, lines 30-31, Mohri teaches away from the treatment by stating that “grinding is not always easy and incurs the cost.” Furthermore, Mohri seeks to produce micron-size particles (not nano-size particles) and considers fine particles undesirable (see, column 2, lines 33-35, “fine powder may be formed or foreign materials may be incorporated only to provide  $\alpha$ -alumina powder unsuitable as an abrasive”).

Even if Mohri is relied upon for teaching milling of aluminum precursor, neither Zachariah nor Mohri teaches the production of plate-like particles. As stated above, and contrary to the Examiner’s assertions, claim 28 is limited to plate-like alumina (see step b)). In addition, the combination of the two prior art references will not result in Applicants’ presently claimed invention with the limitation of the aspect ratio of width to diameter or the volume fraction of the diluents. Moreover, the references do not provide reason, suggestions, or motivation to combine their teachings (MPEP §2143). Thus, combining the references would not be obvious to the ordinary skilled artisan.

Finally, the references must be viewed without the benefit of impermissible hindsight vision afforded by the claimed invention; and there must be a reasonable expectation of success (MPEP §2143.02). The references do not disclose the same plate-like aluminum nano-particles nor teach the process for production of these particles and, instead,

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teach away from the process needed to produce the particles. Neither of the prior art references teach the aspect ratio of width to diameter, or the volume fraction of the diluents. Therefore, there would not be a reasonable expectation of success in obtaining Applicants' inventive plate-like aluminum nano-particles.

Accordingly, claims 41-44 are not obvious to one skilled in the art over Zachariah in view of Mohri. Withdrawal of the rejection is respectfully requested.

**JP 2001058818**

**Novelty over JP 2001058818**

Claims 28-41 are rejected under 35 U.S.C. §102(b) as being anticipated by JP 2001058818 (herein after "JP '818"). We respectfully call attention to claim 41 since it is an independent claim and does not fall within claims 28-40. The rejection is understood to be relevant to claims 28-40.

The Office Action states that JP '818 teaches a platy  $\alpha$ -Al<sub>2</sub>O<sub>3</sub> grain that is produced by heating  $\gamma$ -Al<sub>2</sub>O<sub>3</sub> (page 4, line 12). More specifically, the JP '818 reference teaches the production of a platy  $\alpha$ -Al<sub>2</sub>O<sub>3</sub> grain by heating  $\gamma$ -Al<sub>2</sub>O<sub>3</sub> with sodium sulphate (Na<sub>2</sub>SO<sub>4</sub>) which is used as a flux. The published English abstract of JP '818, states that the temperature, when heat-treating to produce  $\alpha$ -Al<sub>2</sub>O<sub>3</sub>, is preferably regulated to  $\geq 900^{\circ}\text{C}$ , which is above the melting point of preferred diluents sodium sulfate ( $884^{\circ}\text{C}$ ) and sodium chloride ( $801^{\circ}\text{C}$ ). See Office Action at page 4. In the present application, claim 28 includes the step of heat-treating the mixture below the melting point of the diluent. When heat treatment is performed below the melting point of the diluent(s) or below the liquidus of the diluent-mineraliser system, intergrowth of plate-like particles is avoided by virtue of the fact that

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sufficient solid particles of the diluent are present to separate neighboring plate-like particles from one another during growth (page 9, lines 22-28 of the present specification).

The Examiner indicates that JP '818' teaches that the heat treatment of alumina and salt mixture can occur at a temperature of 800°C. See Office Action at page 5, citing paragraph 11 of the detailed description. This is considered by the Examiner to bring JP' 818 within the scope of claim 28. However, it is clearly stated in paragraphs 6 and 12 of JP' 818 that gamma-alumina is formed when the temperature of heat treatment is below 900°C, and that alpha-alumina can only be formed above 900°C. The flux used in JP' 818 is sodium sulphate which has a melting point of 884°C (according to Wikipedia). In contrast, claim 28 recites the feature that plate-like alpha-alumina particles are being formed and heat treatment is carried out at a temperature below the melting point of the diluent. Accordingly, JP '818 does not anticipate claims 28-40 since it does not contain each and every element of the claimed subject matter. Withdrawal of the rejection is respectfully requested.

**Obviousness over JP 2001058818**

Claims 28-41 are rejected under 35 U.S.C. §103(a) as being obvious over JP '818. The Office Action does not indicate how or why a person skilled in the art and armed with the teachings of JP '818 would have been motivated to alter the heat treatment in performing the process of JP '818 without using a molten flux. The process as disclosed in JP '818 would not produce the plate-like aluminum nano-particles because the temperature is too high to avoid intergrowth of plate-like particles and, therefore, there would not be a reasonable expectation of success. In this regard, JP '818 teaches away from the present

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invention by stating  $\geq 900^{\circ}\text{C}$  is the preferred heat-treatment temperature for the disclosed invention (paragraph [0012] in JP '818). The reference does not teach the aspect ratio of width to diameter or the volume fraction of the diluents, as recited in Applicants' presently amended claims. There would not be a reasonable expectation of success in obtaining Applicants' inventive plate-like aluminum nano-particles. Thus, claims 28-40 are non-obvious over JP '818.

JP 2001058818 over Mohri *et al.*

Claims 41-44 are rejected under 35 U.S.C. §103(a) as being obvious over JP '818 in view of Mohri *et al.* The Examiner states that although JP '818 does not expressly teach the milling of the aluminum precursor, Mohr teaches the step of ball milling agglomerated course particles. See Office Action at page 5, citing column 2, lines 21-35 of Mohri. The Examiner then concludes that it would have been obvious to alter the process of JP '818 to include the step of ball milling because a person of ordinary skill in the art would be motivated to produce a product that did not contain agglomerated particles. See Office Action at page 5, citing column 2, lines 29-31 of Mohri. Applicants respectfully traverse the rejection.

Mohri does not cure the deficiencies of JP '818. The references being combined must provide a reason, suggest, or motivate one skilled in the art of the desirability and thus the obviousness of making the combination (MPEP §2143). Moreover, the references must be viewed without the benefit of impermissible hindsight vision afforded by the claimed invention; and there must be a reasonable expectation of success (MPEP §2143.02). Here, again, there is no reason, suggestion, or motivation to combine the

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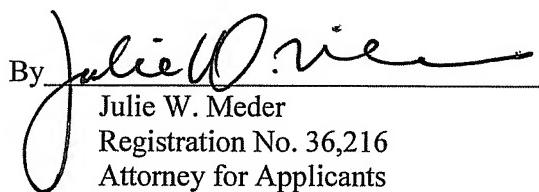
references. In addition, and based on the arguments in the preceding paragraphs, there would not be a reasonable expectation to succeed in producing the plate-like aluminum nanoparticle with the aspect ratio of width to diameter or the volume fraction of the diluents in light of JP '818 in view of Mohri. Thus, claims 41-44 define over their teachings.

**Conclusion**

Applicants respectfully request reconsideration and withdrawal of all rejections. An indication of allowance of all pending claims is respectfully solicited.

In the event any issues remain, Applicants would appreciate the courtesy of a telephone call to their counsel to resolve such issues.

Respectfully submitted,  
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